FP03-0296-00

1/22

Fig.1

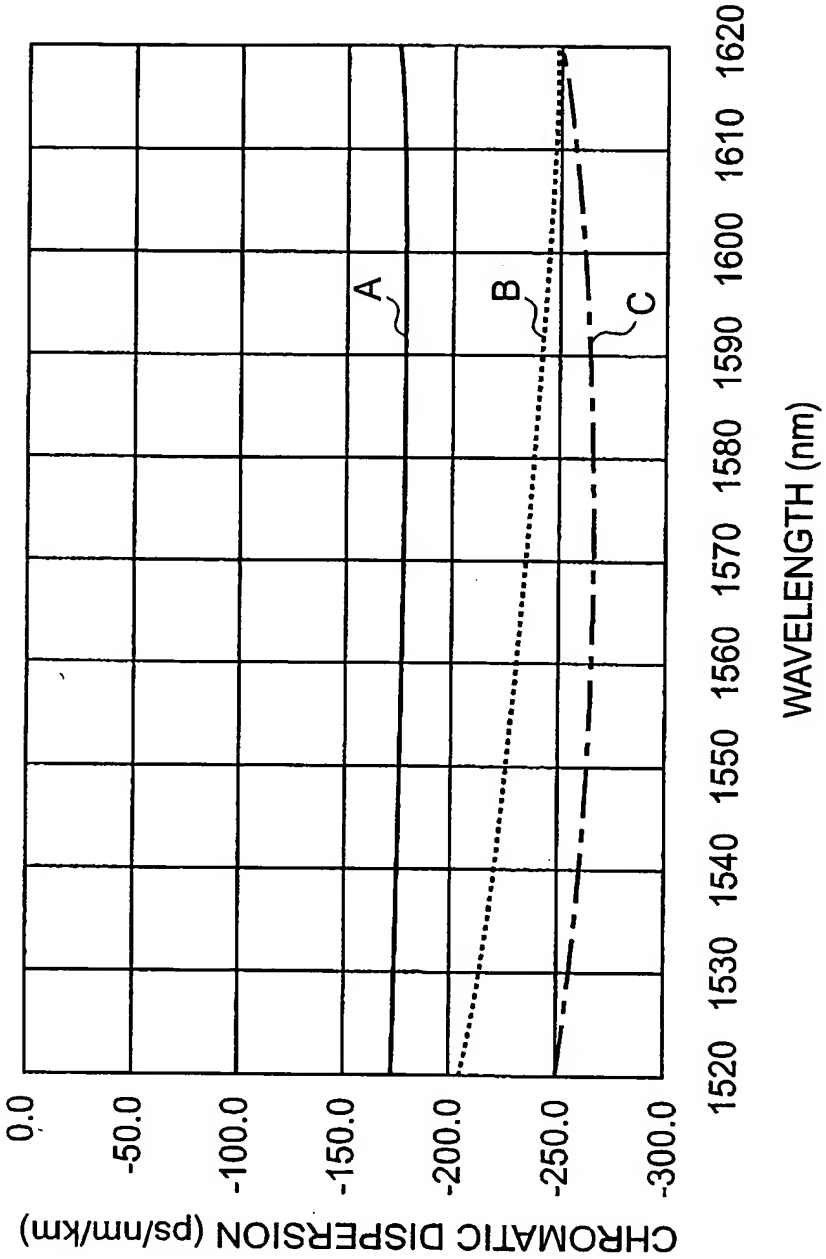


Fig.2A

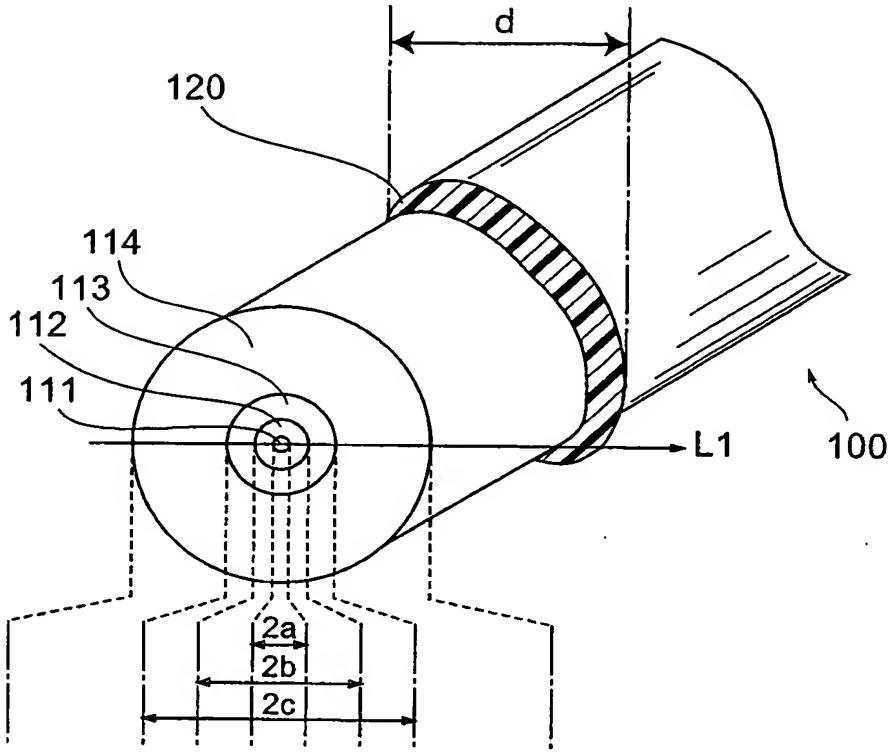
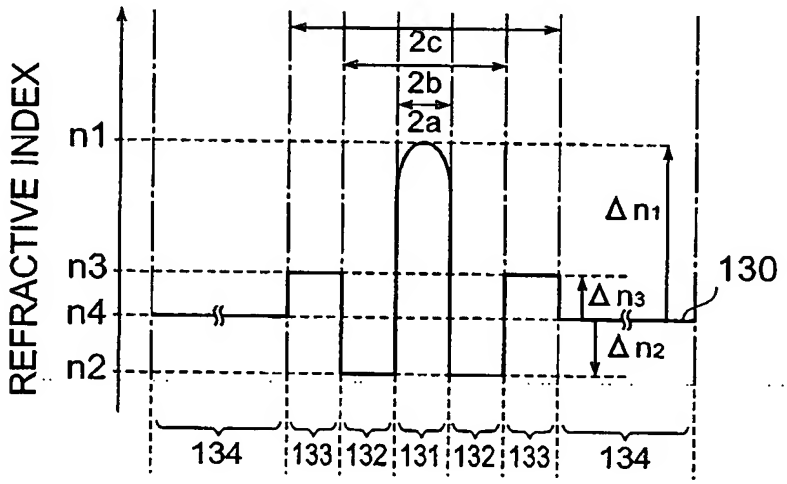

d
120
114
113
112
111
L1
100
2a
2b
2c

Fig.2B


REFRACTIVE INDEX
n1
n3
n4
n2
2c
2b
2a
Δn1
Δn3
Δn2
130
134
133
132
131
132
133
134

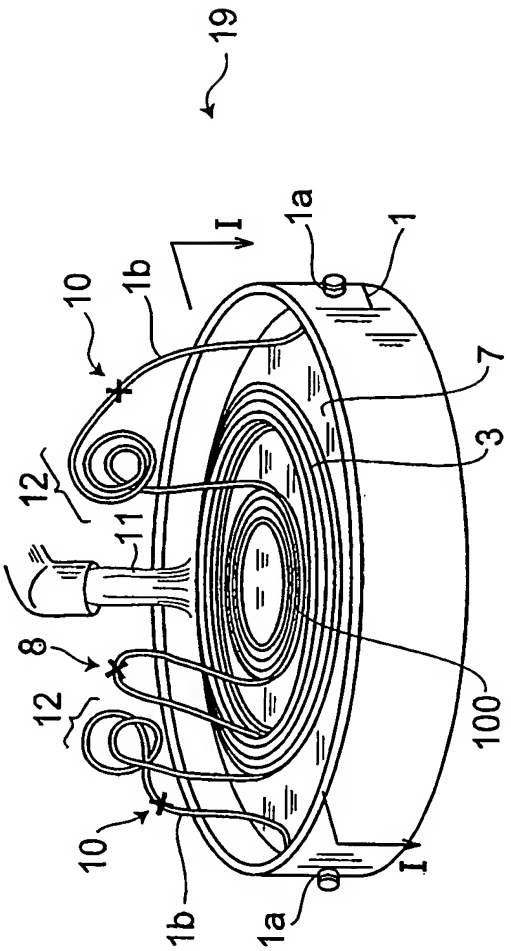

19
I
1a
1
10
1b
7
3
12
11
100
8
12
10
1b
1a
I

Fig.3A

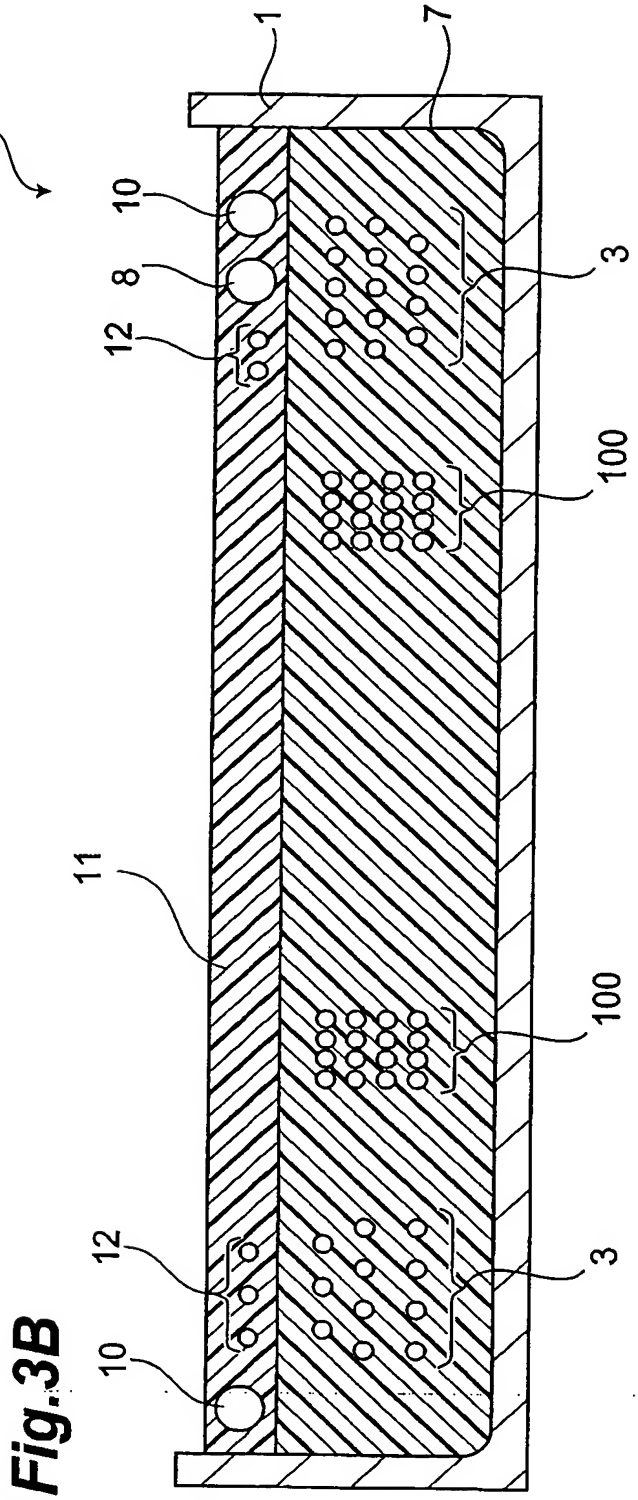

19
1
7
10
8
12
3
100
11
100
12
3
10

Fig.3B

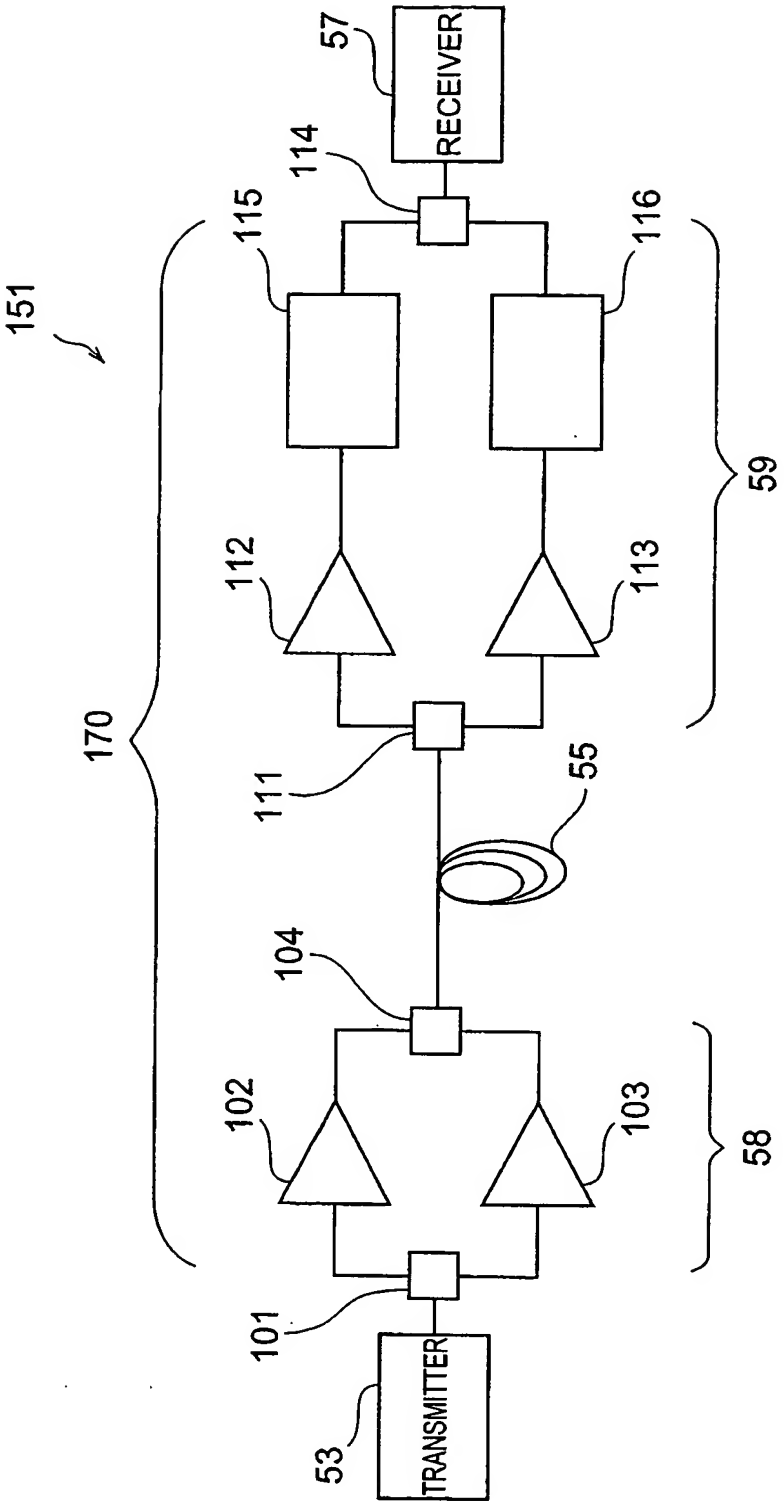

RECEIVER
57
114
115
116
151
59
112
113
170
111
55
104
102
103
58
101
TRANSMITTER
53

Fig.4

Fig.5

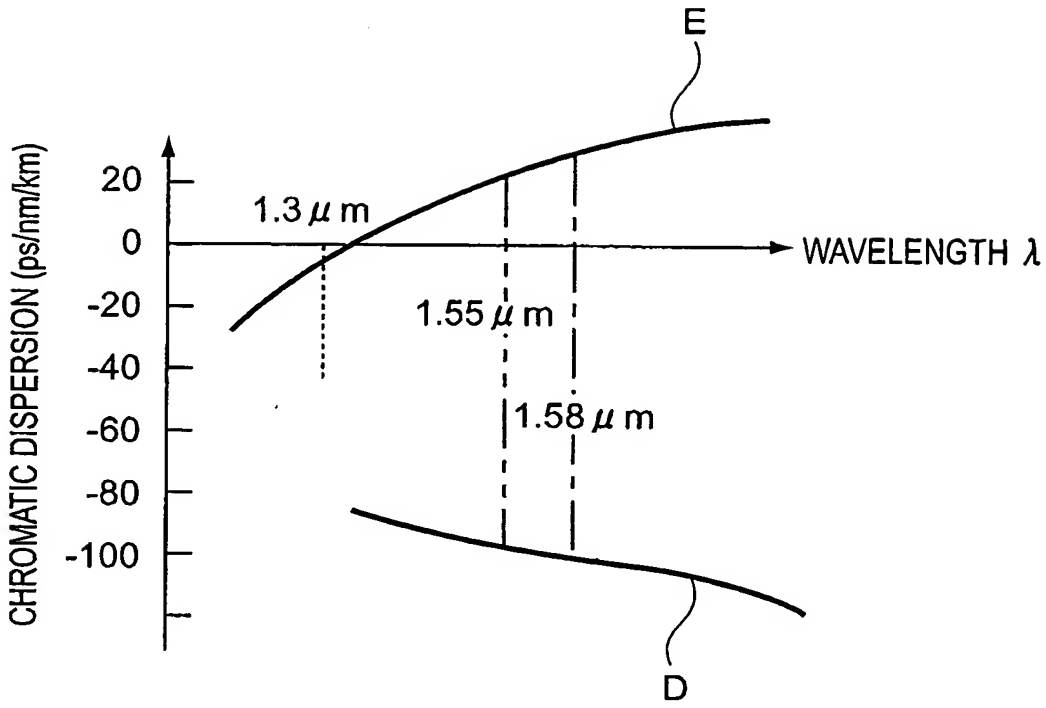

E
CHROMATIC DISPERSION (ps/nm/km)
20
0
-20
-40
-60
-80
-100
1.3 μ m
1.55 μ m
1.58 μ m
WAVELENGTH λ
D

Fig.6

DISPERSION COMPENSATING OPTICAL FIBER	Δn1 (%)	Δn2 (%)	Δn3 (%)	2a (μm)	2b (μm)	2c (μm)	CHROMATIC DISPERSION AT 1520 nm (ps/nm/km)	DISPERSION SLOPE AT 1520 nm (ps/nm2/km)	CHROMATIC DISPERSION AT 1550 nm (ps/nm/km)	DISPERSION SLOPE AT 1550 nm (ps/nm2/km)	EFFECTIVE CUTOFF WAVELENGTH (μm)	MFD AT 1550 nm (μm)	INCREASE IN BENDING LOSS WITH BENDING DIAMETER OF 40 mm AT 1550 nm (dB/km)	INCREASE IN BENDING LOSS WITH BENDING DIAMETER OF 60 mm AT 1550 nm (dB/km)
SAMPLE F1	2.8	-0.74	0.32	2.6	5.2	10.8	-172	-0.16	-176	-0.08	1.28	4.0	≦0.01	≦0.01
SAMPLE F2	2.8	-0.74	0.32	3.2	7.7	15.4	-249	-0.64	-263	-0.28	1.45	4.2	≦0.05	≦0.01
COMPARATIVE EXAMPLE F3	1.6	-0.50	0.30	4.3	11.0	15.4	-61	-0.25	-70	-0.36	1.40	4.7	≦0.5	≦0.02

Fig.7

DISPERSION COMPENSATOR	PREPARED FIBER	FIBER LENGTH (km)	GLASS DIAMETER (μm)	COATING DIAMETER (μm)	TOTAL CHROMATIC DISPERSION (ps/nm)	TOTAL DISPERSION SLOPE (ps/nm²)	INSERTION LOSS (dB)	ACCOMMODATION STATE OF FIBER	INNER DIAMETER OF COIL (mm)	OUTER DIAMETER OF COIL (mm)	HOUSING SIZE(mm)		
											LONG	WIDE	HIGH
SAMPLE M1	F1	1.7	80	140	-300	-0.13	3.3	RESIN HOLD	40		120	120	18
SAMPLE M2	F1	1.7	125	185	-300	-0.13	3.3	RESIN HOLD	40		120	120	18
SAMPLE M3	F1	3.4	125	185	-600	-0.26	4.6	RESIN HOLD	40		130	130	17
SAMPLE M4	F2	0.30	80	185	-80	-0.08	2.1	RESIN HOLD	60		100	100	14
SAMPLE M5	F2	1.14	125	185	-300	-0.31	2.8	RESIN HOLD	60		120	120	18
SAMPLE M6	F2	2.28	125	185	-600	-0.63	3.7	RESIN HOLD	60		130	130	17
SAMPLE M7	F2	4.56	125	185	-1200	-1.26	5.6	RESIN HOLD	60		170	170	17
SAMPLE M8	F2	2.30	125	185	-604	-0.63		RESIN HOLD	40		220	230	40
	F3	10.8	125	185	-756	-3.88		RESIN HOLD	120	200			
	F2+F3				-1360	-4.5	7						

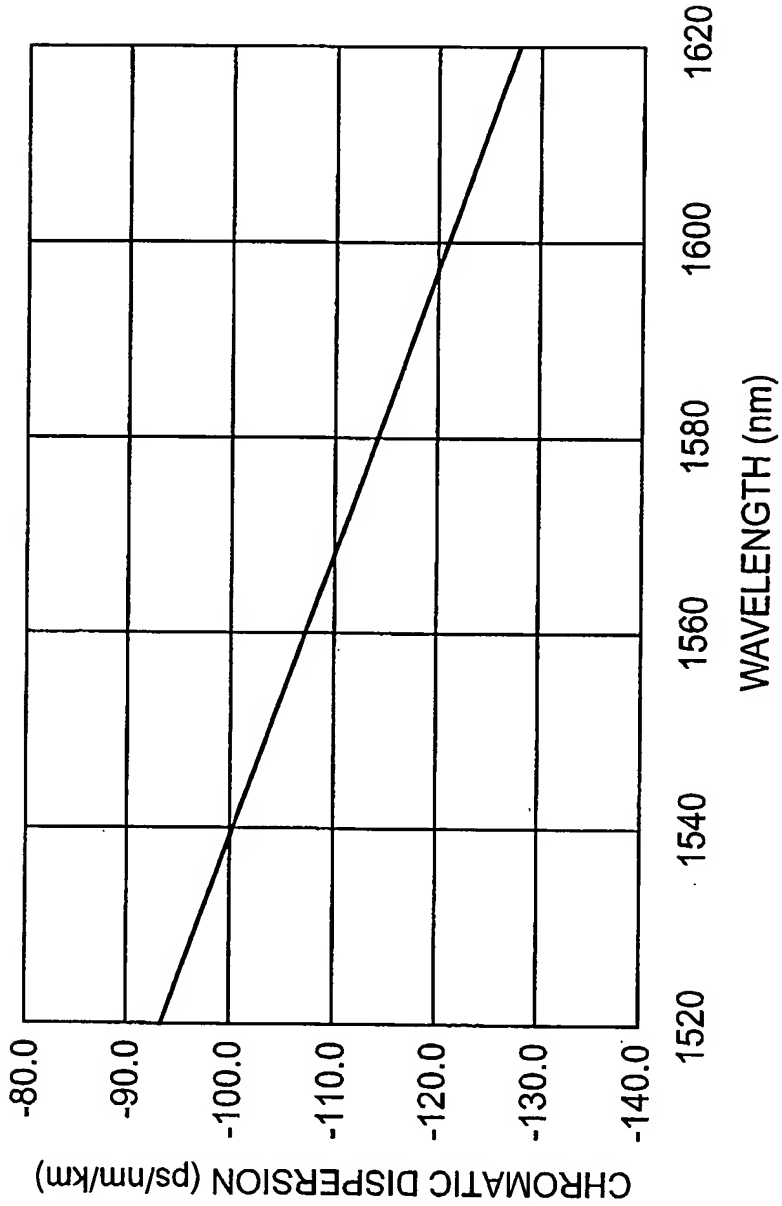

CHROMATIC DISPERSION (ps/nm/km)
-80.0
-90.0
-100.0
-110.0
-120.0
-130.0
-140.0
WAVELENGTH (nm)
1520
1540
1560
1580
1600
1620

Fig.8

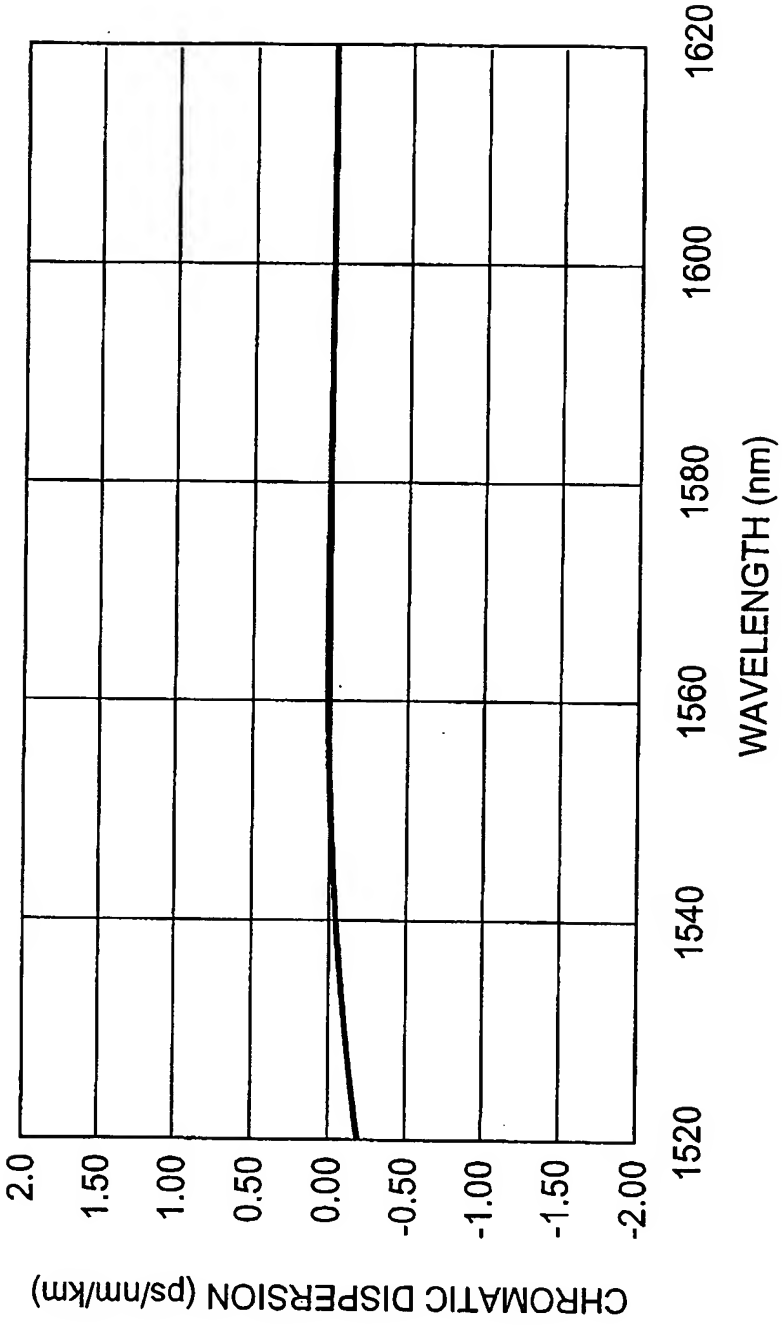

CHROMATIC DISPERSION (ps/nm/km)
2.0
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
1520
1540
1560
1580
1600
1620
WAVELENGTH (nm)

Fig.9

Fig.10

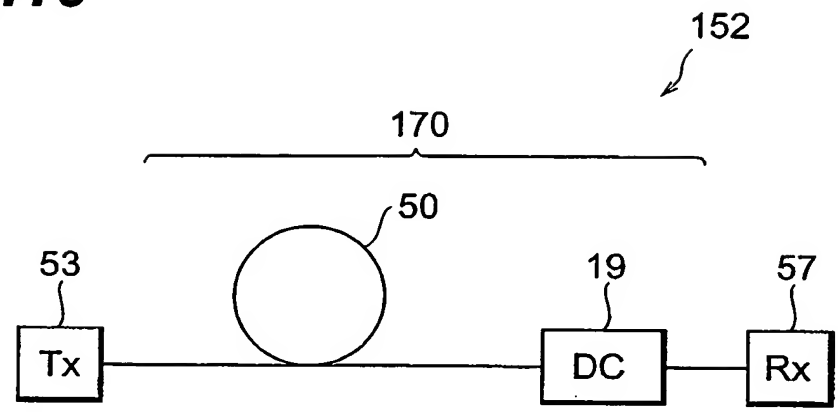


Fig.11

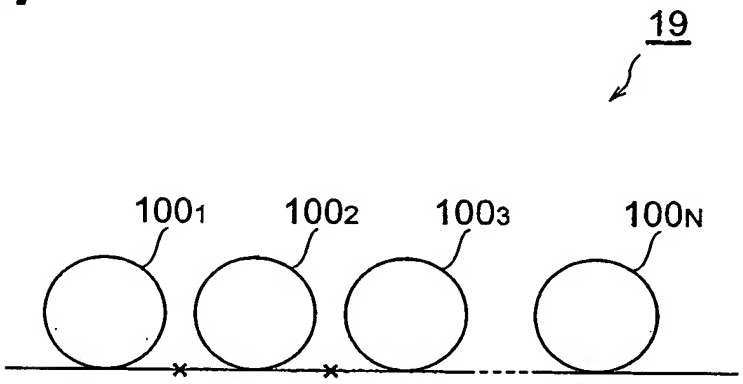


Fig.12

DISPERSION COMPENSATING OPTICAL FIBER	Δn1 (%)	Δn2 (%)	Δn3 (%)	Δn4 (%)	2a (μm)	2b (μm)	2c (μm)	2d (μm)	CHROMATIC DISPERSION AT 1550 nm (ps/nm/km)	DISPERSION SLOPE AT 1550 nm (ps/nm²/km)	DISPERSION CURVATURE (ps/nm³/km)	RDS AT 1550 nm (1/nm)	RDC AT 1550 nm (1/nm²)	EFFECTIVE CUTOFF WAVELENGTH (μm)	BENDING LOSS WITH BENDING DIAMETEROF 40 mm AT 1550 nm (dB)	BENDING LOSS WITH BENDING DIAMETEROF 60 mm AT 1550 nm (dB)
SAMPLE F4	2.8	-0.74	0.32	-	3.2	7.7	15.4	-	-263	-0.28	0.0129	0.0010	-4.90E-05	1.45	≦0.05	≦0.01
SAMPLE F5	2.7	-0.76	0.31	-	3	7.4	14.8	-	-299	-0.31	0.0256	0.0010	-8.59E-05	1.61	≦0.05	≦0.01
SAMPLE F6	2.7	-0.78	0.42	-	2.9	7.3	13.2	-	-321	-0.94	0.0460	0.0029	-1.43E-04	1.70	≦0.1	≦0.01
SAMPLE F7	1.6	-0.5	0.3	-	4.2	11.7	16	-	-82	-0.60	-0.0066	0.0074	8.05E-05	1.40	≦0.5	≦0.02
SAMPLE F8	1.6	-0.5	0.3	-	4.3	10.9	15.2	-	-71	-0.38	-0.0038	0.0054	5.34E-05	1.40	≦0.5	≦0.02
SAMPLE F9	1.6	-0.77	0.41	-0.38	1.7	5.7	9.2	11.4	-184	-3.70	-0.0670	0.0201	3.65E-04	1.62	≦2.0	≦0.05
SAMPLE F10	2.6	-0.77	0.42	-	2.9	7.1	13.2	-	-329	1.10	0.0479	-0.0033	-1.45E-04	1.72	≦0.1	≦0.01
SAMPLE F11	2.7	-0.76	0.31	-	2.87	6.88	14.3	-	-329	-0.58	0.0276	0.0018	-8.41E-05	1.58	≦0.05	≦0.01
SAMPLE F12	2.7	-0.76	0.31	-	2.85	6.86	14.4	-	-338	-0.04	0.0423	0.0001	-1.25E-04	1.58	≦0.05	≦0.01
SAMPLE F13	1.6	-0.5	0.3	-	4.2	11.4	16.1	-	-76	-0.49	-0.0049	0.0065	6.54E-05	1.40	≦0.5	≦0.02
SAMPLE F14	2.2	-0.72	0.3	-	3.58	10.6	17.5	-	-166	-3.03	-0.0881	0.0182	5.30E-04	1.57	≦5.0	≦0.05

TRANSMISSION FIBER									CHROMATIC DISPERSION AT 1550 nm (ps/nm/km)	DISPERSION SLOPE AT 1550 nm (ps/nm²/km)	DISPERSION CURVATURE (ps/nm³/km)	RDS AT 1550 nm (1/nm)	RDC AT 1550 nm (1/nm²)			
SAMPLE F15									17.0	0.059	-8.94E-05	0.0035	-5.27E-06			
SAMPLE F16									8.0	0.060	-2.58E-05	0.0075	-3.21E-06			
SAMPLE F17									4.5	0.044	4.09E-05	0.0098	9.11E-06			

Fig.13A

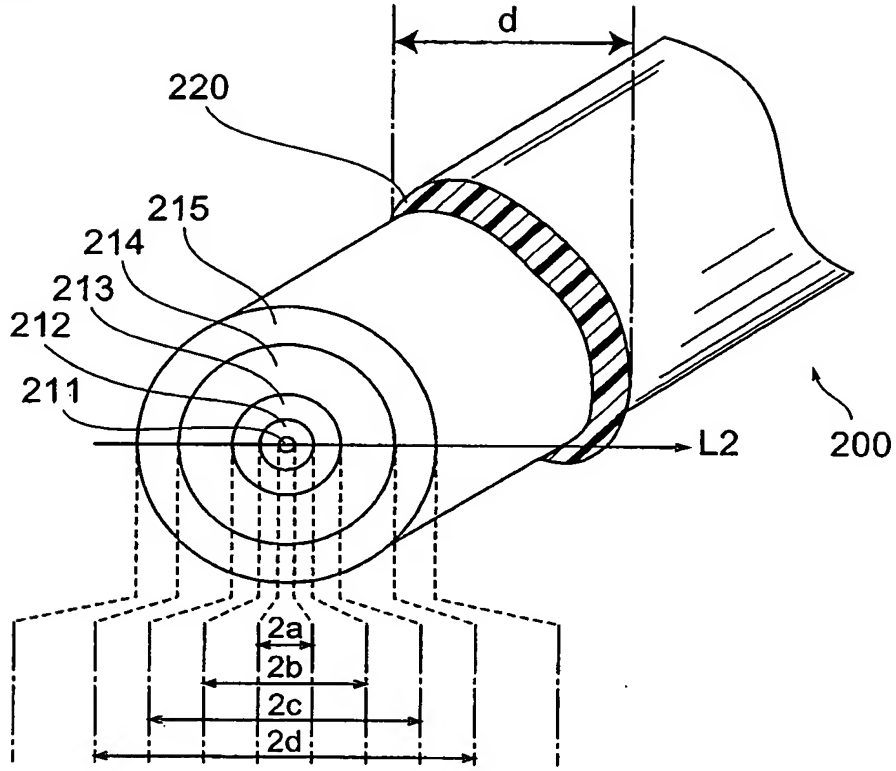


Fig.13B

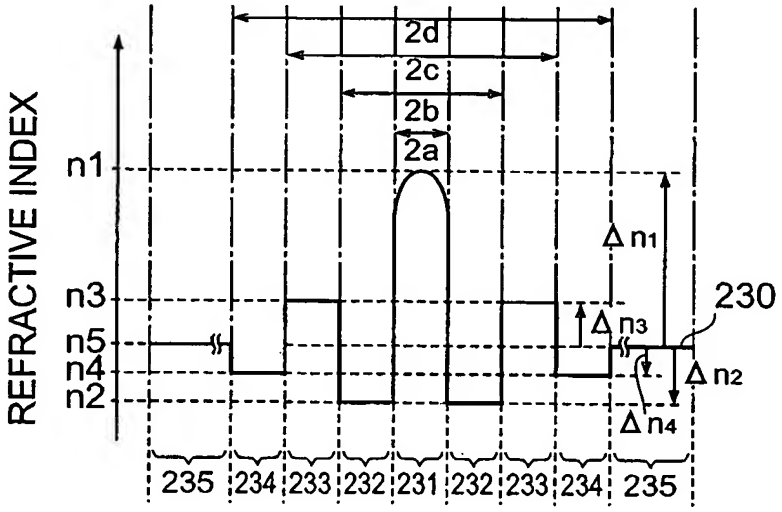


Fig.14

DISPERSION COMPENSATOR	PREPARED FIBER	FIBER LENGTH (km)	GLASS DIAMETER (μm)	COATING DIAMETER (μm)	TOTAL CHROMATIC DISPERSION (ps/nm/km)	TOTAL DISPERSION SLOPE (ps/nm²/km)	TOTAL DISPERSION CURVATURE (ps/nm³/km)	RDS (1/nm)	RDC (1/nm²)	INSERTION LOSS (dB)	PMD (ps)	NONLINEAR PHASE SHIFT (10^{-4})	ACCOMMODATION STATE OF FIBER	INNER DIAMETER OF COIL (mm)
SAMPLE M9	F4	3.94	125	185								3.51	RESIN HOLD	40
	F7	8.03	125	185								1.81	RESIN HOLD	120
	F1+F7				-1694	-5.94	-0.0024	0.0035	1.42E-06	7.90	0.49	5.32		
SAMPLE M10	F5	2.00	125	185								1.53	RESIN HOLD	40
	F8	10.73	125	185								2.73	RESIN HOLD	120
	F5+F8				-1356	-4.69	0.0107	0.0035	-7.88E-06	6.95	0.43	4.26		
SAMPLE M11	F6	1.84	125	185								0.68	RESIN HOLD	60
	F9	1.15	150	195								0.24	RESIN HOLD	160
	F6+F9				-802	-5.99	0.0076	0.0075	-9.48E-06	3.70	0.29	0.92		
SAMPLE M12	F6	0.82	125	185								0.26	RESIN HOLD	60
	F9	0.99	150	195								0.21	RESIN HOLD	160
	F6+F9				-447	-4.45	-0.0286	0.0100	6.40E-05	2.62	0.21	0.47		

Fig.15

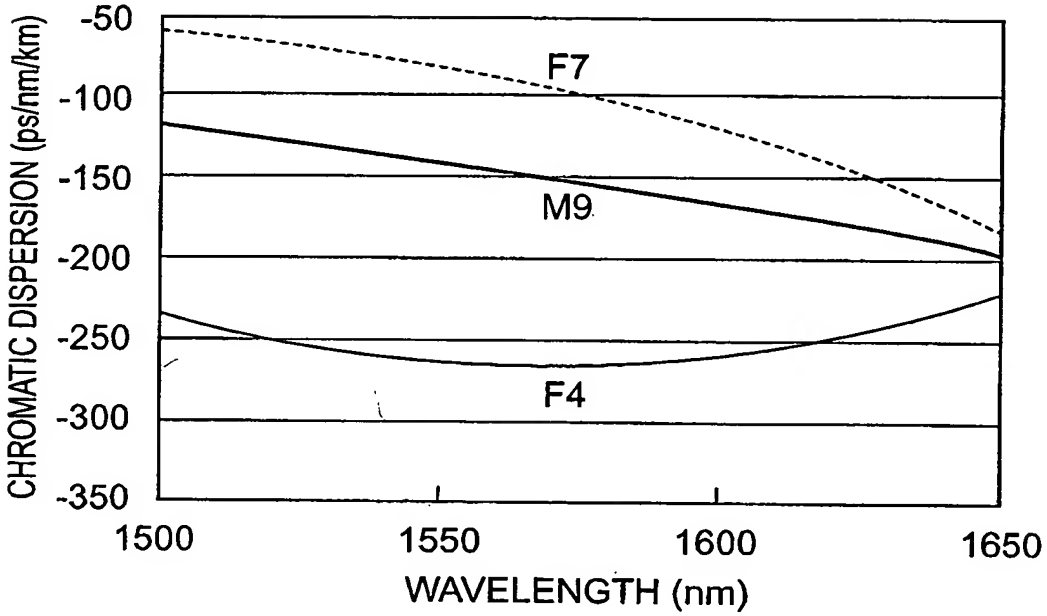

-50
-100
-150
-200
-250
-300
-350
CHROMATIC DISPERSION (ps/nm/km)
F7
M9
F4
1500
1550
1600
1650
WAVELENGTH (nm)

Fig.16

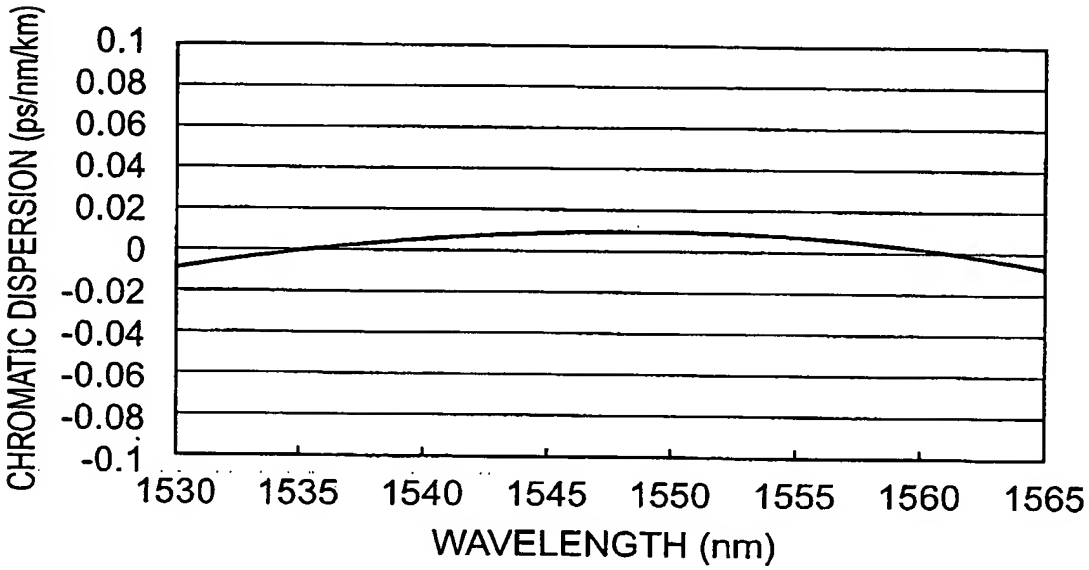

0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
CHROMATIC DISPERSION (ps/nm/km)
1530
1535
1540
1545
1550
1555
1560
1565
WAVELENGTH (nm)

Fig.17

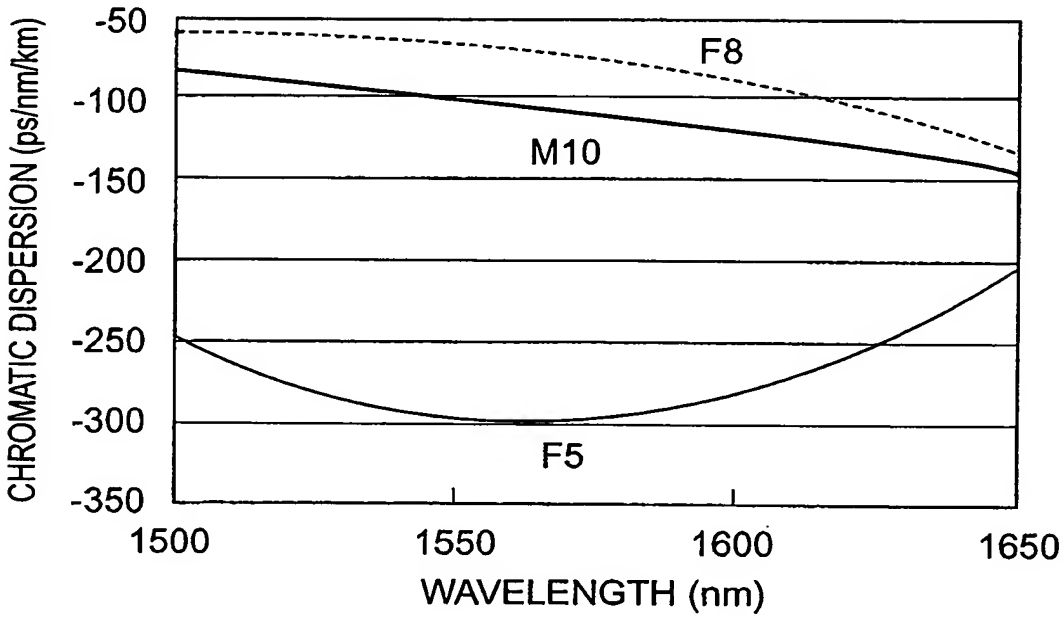

CHROMATIC DISPERSION (ps/nm/km)
-50
-100
-150
-200
-250
-300
-350
F8
M10
F5
1500
1550
1600
1650
WAVELENGTH (nm)

Fig.18

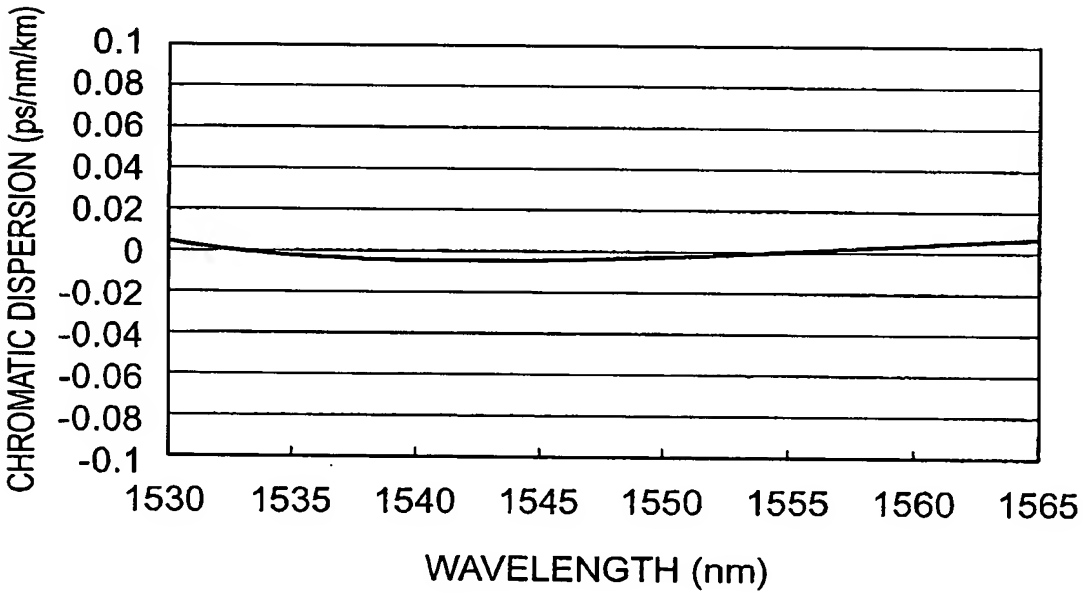

CHROMATIC DISPERSION (ps/nm/km)
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
1530
1535
1540
1545
1550
1555
1560
1565
WAVELENGTH (nm)

Fig.19

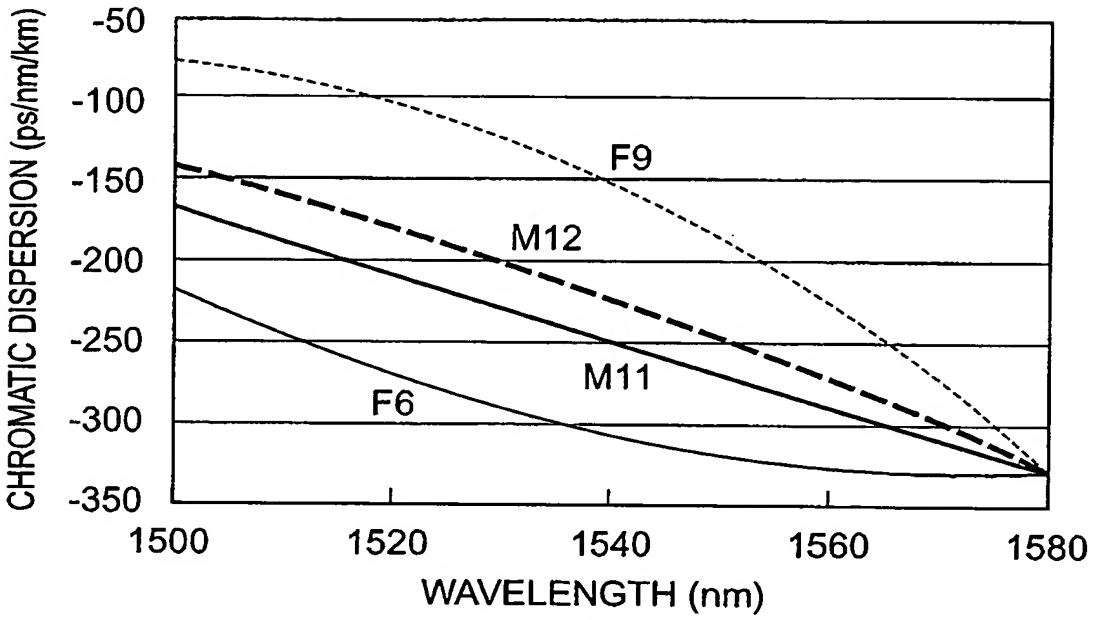

CHROMATIC DISPERSION (ps/nm/km)
-50
-100
-150
-200
-250
-300
-350
F9
M12
M11
F6
1500
1520
1540
1560
1580
WAVELENGTH (nm)

Fig.20

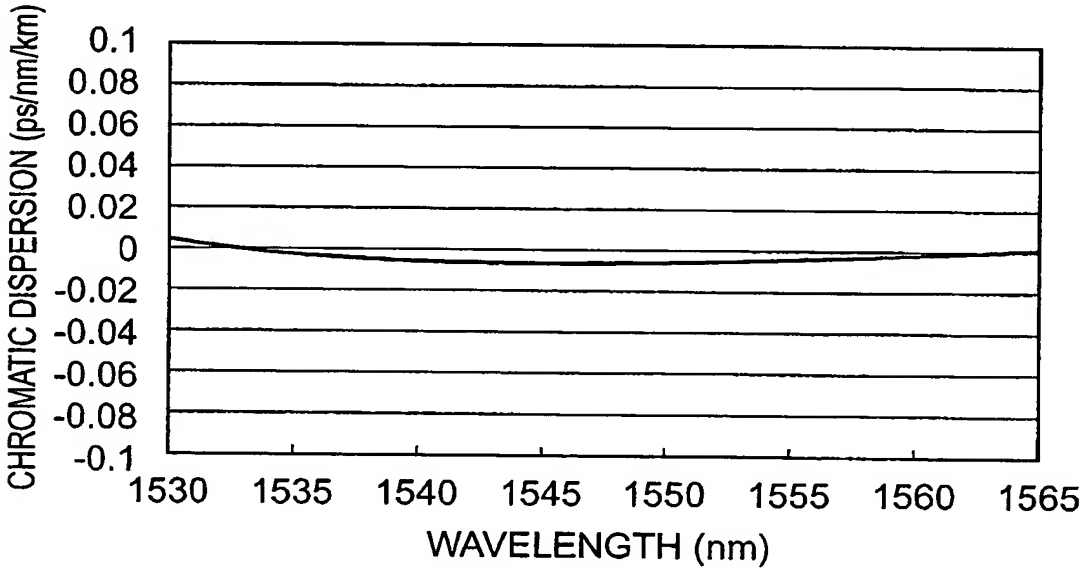

CHROMATIC DISPERSION (ps/nm/km)
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
1530
1535
1540
1545
1550
1555
1560
1565
WAVELENGTH (nm)

Fig.21

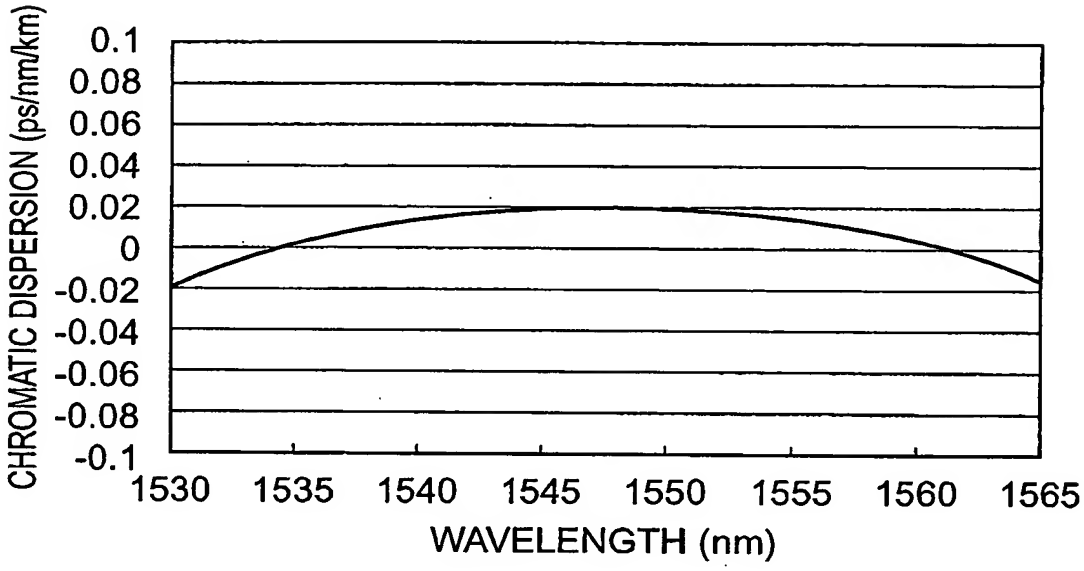

CHROMATIC DISPERSION (ps/nm/km)
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
1530
1535
1540
1545
1550
1555
1560
1565
WAVELENGTH (nm)

Fig.22

FIRST OPTICAL FIBER			SECOND OPTICAL FIBER			DISPERSION COMPENSATOR			OPTICAL TRANSMISSION LINE	
SAMPLE	RDS1 (1/nm)	RDC1 ($1/nm^2$)	SAMPLE	RDS2 (1/nm)	RDC2 ($1/nm^2$)	SAMPLE	RDS0 (1/nm)	RDC0 ($1/nm^2$)	TRANSMISSION FIBER	RESIDUAL DISPERSION (ps/nm/km)
F4	0.0010	-4.90E-05	F7	0.0074	8.05E-05	M9	0.0035	1.42E-06	F15	±0.0086
F5	0.0010	-8.59E-05	F8	0.0054	5.34E-05	M10	0.0035	-7.88E-06	F15	±0.0056
F4	0.0010	-4.90E-05	F13	0.0065	6.54E-05	M13	0.0035	2.31E-06	F15	±0.0100
F10	-0.0033	-1.45E-04	F13	0.0065	6.54E-05	M14	0.0035	-6.17E-07	F15	±0.0056
F6	0.0029	-1.43E-04	F9	0.0201	3.65E-04	M11	0.0075	-9.48E-06	F16	±0.0050
F5	0.0010	-8.59E-05	F9	0.0201	3.65E-04	M15	0.0076	6.86E-05	F16	±0.0477
F11	0.0018	-8.41E-05	F9	0.0201	3.65E-04	M16	0.0077	6.10E-05	F16	±0.0438
F12	0.0001	-1.25E-04	F9	0.0201	3.65E-04	M17	0.0076	5.71E-05	F16	±0.0374
F6	0.0029	-1.43E-04	F14	0.0182	5.30E-04	M18	0.0073	5.05E-05	F16	±0.0277
F6	0.0029	-1.43E-04	F9	0.0201	3.65E-04	M12	0.0099	6.42E-05	F17	±0.0186

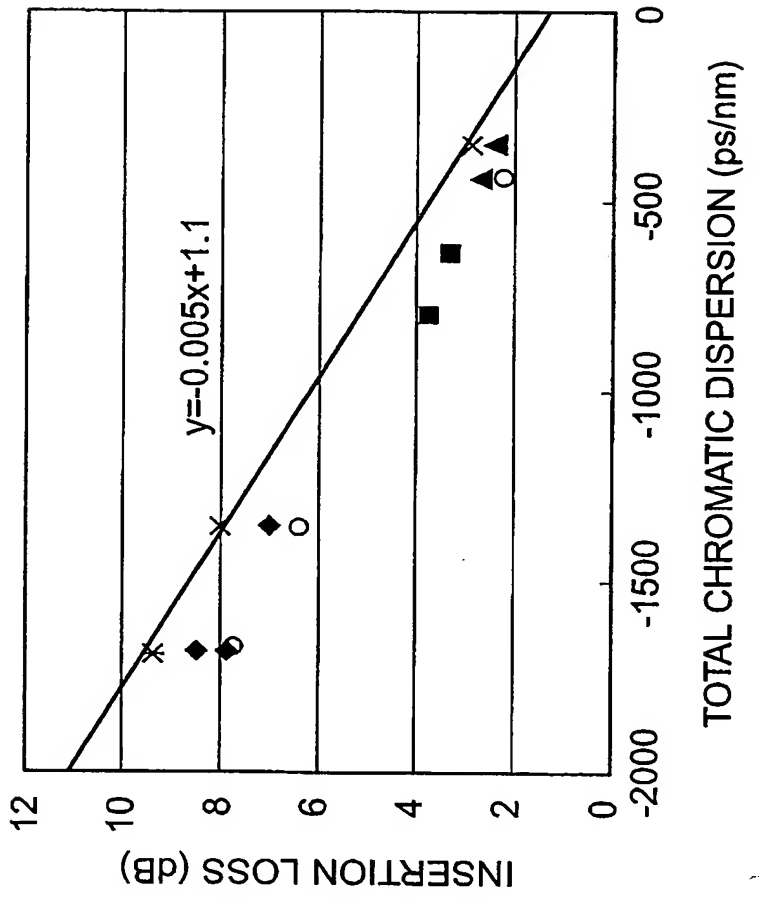

y=-0.005x+1.1
INSERTION LOSS (dB)
TOTAL CHROMATIC DISPERSION (ps/nm)
0
2
4
6
8
10
12
0
-500
-1000
-1500
-2000

Fig.23

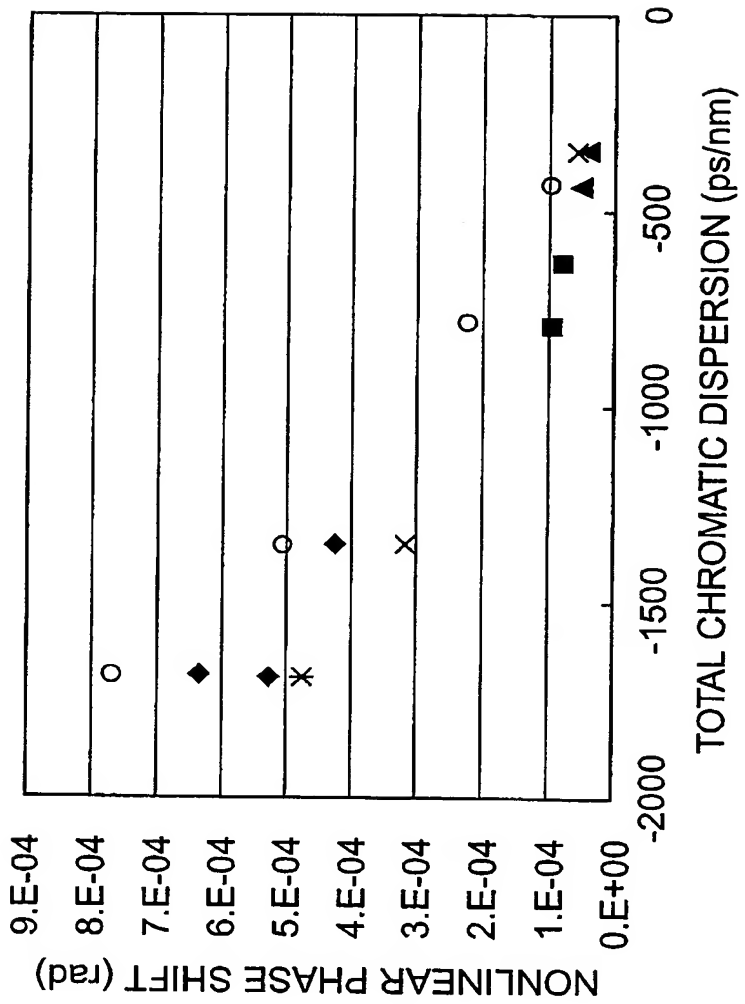

NONLINEAR PHASE SHIFT (rad)
9.E-04
8.E-04
7.E-04
6.E-04
5.E-04
4.E-04
3.E-04
2.E-04
1.E-04
0.E+00
-2000
-1500
-1000
-500
0
TOTAL CHROMATIC DISPERSION (ps/nm)

Fig.24

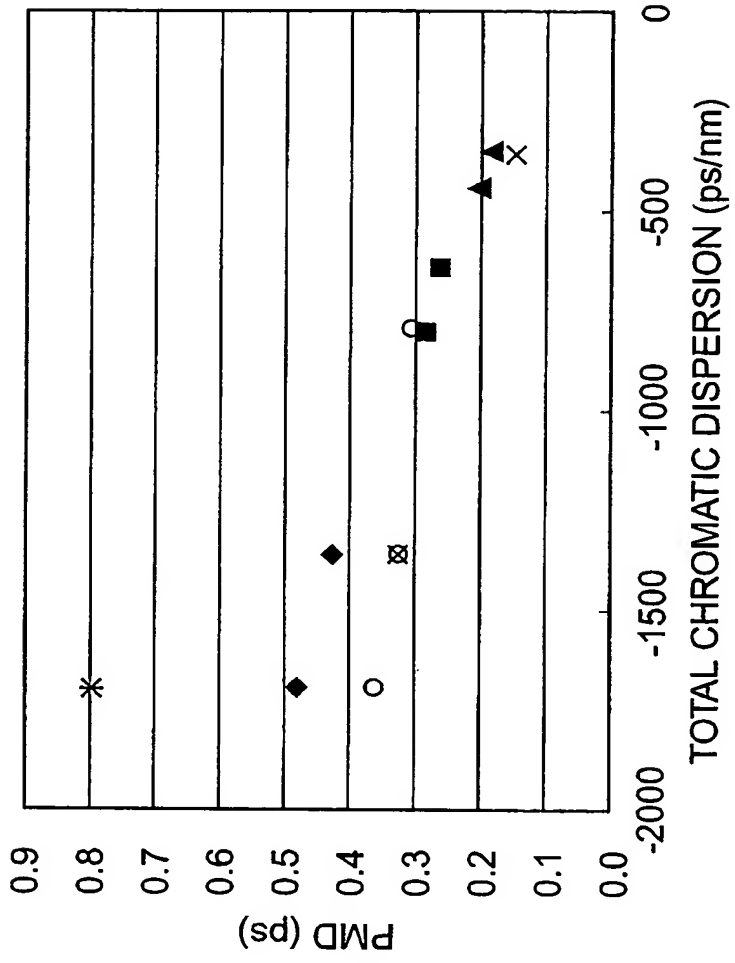
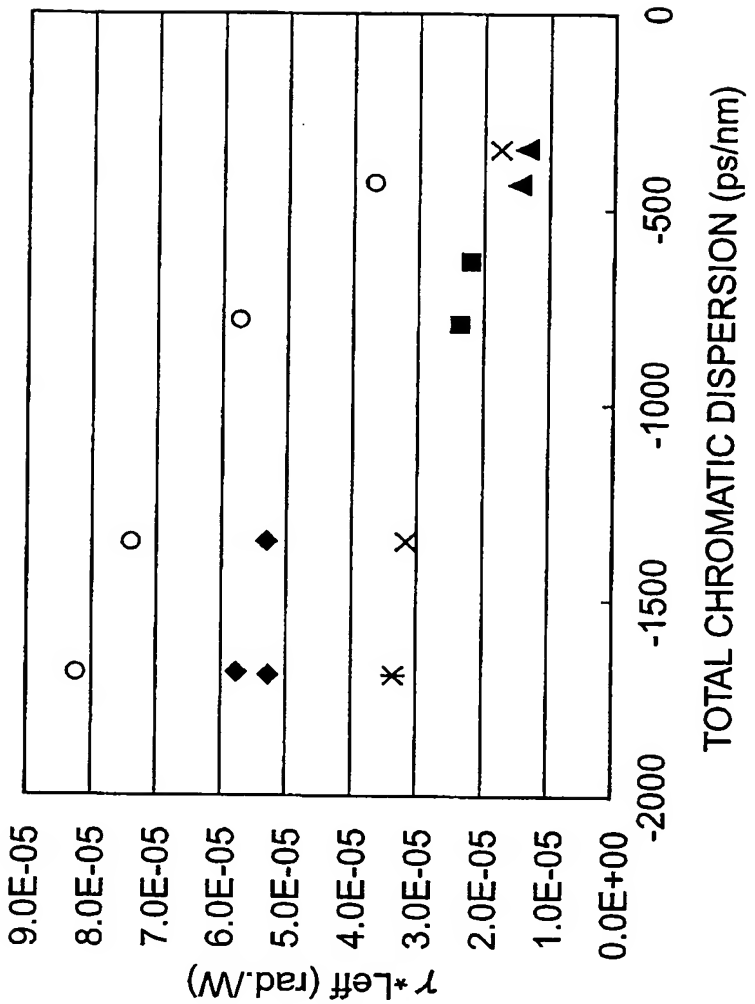

PMD (ps)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
TOTAL CHROMATIC DISPERSION (ps/nm)
0
-500
-1000
-1500
-2000

Fig.25

Fig.26


9.0E-05
8.0E-05
7.0E-05
6.0E-05
5.0E-05
4.0E-05
3.0E-05
2.0E-05
1.0E-05
0.0E+00
γ*Leff (rad./W)
-2000
-1500
-1000
-500
0
TOTAL CHROMATIC DISPERSION (ps/nm)